

What is claimed is:

1. An in-band signaling model media control (MC) terminal for a Home Phoneline Network Association (HPNA) network, the MC terminal comprising:

a frame classification entity (FCE) located at a logical link control (LLC) sublayer of the MC terminal, the FCE receiving a data frame from a higher layer of the MC terminal than the LLC sublayer, the received data frame being part of a down-stream Quality of Service (QoS) stream, the FCE classifying the data frame received from the higher layer of the MC terminal for a media access control (MAC) sublayer based on QoS information contained in the data frame received from the higher layer of the MC terminal, and associating the classified data frame with a QoS stream queue corresponding to a classification of the data frame and being physically located at the MC terminal; and

a frame scheduling entity (FSE) located at the MAC sublayer of the MC terminal, the FSE scheduling transmission of the data frame to a destination for the data frame based on a QoS requirement associated with the down-stream QoS stream.

2. The in-band signaling model MC terminal according to claim 1, wherein the FCE includes a frame classification table containing at least one entry having a frame classifier that is used for classifying the received data frame based on the QoS information contained in the data frame received from the higher layer of the MC terminal.

3. The in-band signaling model MC terminal according to claim 1, wherein the FSE includes a frame scheduling table containing an entry having QoS scheduling information for the QoS stream queue associated with the classified data frame.

4. The in-band signaling model MC terminal according to claim 3, wherein the QoS scheduling information includes at least one QoS parameter value, a QoS stream identification (ID) for the QoS stream of the classified data frame and queue status information for the QoS stream queue.

5. The in-band signaling model MC terminal according to claim 4, wherein the queue status information for the QoS stream queue includes queue length information and a last transmission time for a data frame associated with the QoS stream queue.

6. The in-band signaling model MC terminal according to claim 3, wherein the FSE includes a timer that is associated with the QoS stream queue that is physically located at the MC terminal, the FSE resetting the timer when the QoS stream queue is not empty and enabling the timer to measure an elapsed time when the QoS stream queue becomes empty, the FSE removing the entry in the frame scheduling table for the down-stream QoS stream when the QoS stream queue is empty and a predetermined amount of time elapses.

7. The in-band signaling model MC terminal according to claim 6, wherein the FSE sends a message to the FCE for removing the entry in the frame classification table for the down-stream QoS stream when the QoS stream queue is empty and the predetermined amount of time elapses.

8. The in-band signaling model MC terminal according to claim 6, wherein the predetermined amount of time corresponds to at least three times a maximum delay parameter associated with the down-stream QoS stream.

9. The in-band signaling model MC terminal according to claim 1, wherein the QoS stream queue includes a plurality of QoS streams.

10. The in-band signaling model MC terminal according to claim 1, wherein the QoS stream is a new session and the received data frame is a first data frame received for the QoS stream, and

wherein the FCE adds a new entry to the classification table corresponding to the QoS information contained in the first data frame when the classification table does not contain an entry having a frame classifier corresponding to the QoS information contained in the first data frame;

wherein the FSE adds a new entry to the scheduling table corresponding to the new QoS stream.

11. The in-band signaling model MC terminal according to claim 1, wherein the down-stream QoS stream is a multimedia session QoS stream.

12. The in-band signaling model MC terminal according to claim 1, wherein the down-stream QoS stream is a voice session QoS stream.

13. The in-band signaling model MC terminal according to claim 1, wherein the down-stream QoS stream is a data session QoS stream.

14. The in-band signaling model MC terminal according to claim 1, wherein the destination for the data frame received by the FCE of the MC terminal is at least one in-band signaling model non-media control (non-MC) terminal, each destination non-MC terminal including an FCE located at an LLC sublayer of the non-MC terminal, the FCE of at least one non-MC terminal receiving a data frame from a higher layer of the non-MC terminal than the LLC sublayer of the non-MC terminal, the data frame received from the higher layer of the non-MC terminal being part of a QoS stream originating at the non-MC terminal, the FCE of the non-MC terminal classifying the data frame received from the higher layer of the non-MC terminal for a MAC sublayer of the non-MC terminal based on QoS information contained in the data frame received from the higher layer of the non-MC terminal.

15. The in-band signaling model MC terminal according to claim 14, wherein the QoS stream originating at the non-MC terminal is an up-stream QoS stream.

16. The in-band signaling model MC terminal according to claim 14, wherein the QoS stream originating at the non-MC terminal is a side-stream QoS stream.

17. The in-band signaling model MC terminal according to claim 14, wherein the FCE of the non-MC terminal includes a frame classification table containing at least one entry having a frame classifier that is used for classifying the data frame received from the

higher layer of the non-MC terminal based on the QoS information contained in the received data frame.

18. The in-band signaling model MC terminal according to claim 17, wherein the QoS stream of the data frame received from the higher layer of the non-MC terminal is a new session and the data frame received from the higher layer of the non-MC terminal is a first data frame received by the FCE of the non-MC terminal for the QoS stream,

wherein the FCE of the non-MC terminal adds a new entry to the frame classification table of the non-MC terminal corresponding to the QoS information contained in the first data frame received from the higher layer of the non-MC terminal when the frame classification table of the FCE of the non-MC terminal does not contain an entry having a frame classifier corresponding to the QoS information contained in the first data frame received from the higher layer of the non-MC terminal;

wherein the non-MC terminal sends a reservation request message to the MC terminal; and

wherein the FSE of the MC terminal adds a new entry to its scheduling table upon receiving the reservation request message.

19. The in-band signaling model MC terminal according to claim 17, the non-MC terminal includes a counter that is associated with the QoS stream queue for the QoS stream originating at the non-MC terminal, the FCE of the non-MC terminal setting the counter to zero when a data frame that is part of the QoS stream originating at the non-MC terminal is transmitted in response to a polling message and incrementing the counter when no data frame that is part of the QoS stream originating at the non-MC terminal is transmitted in

response to the polling message, the non-MC terminal removing the entry in the frame classification table corresponding to the QoS stream originating at the non-MC terminal when a count of the counter that is associated with the QoS stream originating at the non-MC terminal equals a predetermined value.

20. The in-band signaling model MC terminal according to claim 19, wherein the predetermined value equals three.

21. The in-band signaling model MC terminal according to claim 14, wherein the MC terminal includes a virtual QoS stream queue corresponding to the QoS stream originating at the non-MC terminal, and

wherein the FSE at the MC terminal includes a counter that is associated with the virtual QoS stream queue, the FSE setting the counter to zero when a data frame that is part of the QoS stream is transmitted by the non-MC terminal in response to a polling message and incrementing the counter when no data frame that is part of the QoS stream is transmitted by the non-MC terminal in response to the polling message, the FSE removing an entry in the frame scheduling table at the MC terminal for the QoS stream originating at the non-MC terminal when a count of the counter that is associated with the virtual QoS stream queue equals a predetermined value.

22. The in-band signaling model MC terminal according to claim 21, wherein the predetermined value equals three.

23. An in-band signaling model non-media control (MC) terminal for a Home Phoneline Network Association (HPNA) network, the non-MC terminal comprising:

a Quality of Service (QoS) stream queue physically located at a media access control (MAC) sublayer of the non-MC terminal, the QoS stream having at least one associated QoS parameter value; and

a frame classification entity (FCE) located at a logical link control (LLC) sublayer of the non-MC terminal, the FCE receiving a data frame from a higher layer of the non-MC terminal than the LLC layer of the non-MC terminal, the data frame received from the higher layer of the non-MC terminal being part of a QoS stream, the FCE of the non-MC terminal classifying the data frame received from the higher layer of the non-MC terminal for the MAC layer of the non-MC terminal based on QoS information contained in the data frame received from the higher layer of the non-MC terminal, the FCE of the non-MC terminal associating the classified data frame with the QoS stream queue when a classification of the data frame corresponds to the at least one QoS parameter value associated with the QoS stream queue.

24. The in-band signaling model non-MC terminal according to claim 23, wherein the QoS stream is an up-stream QoS stream.

25. The in-band signaling model non-MC terminal according to claim 23, wherein the QoS stream is a side-stream QoS stream.

26. The in-band signaling model non-MC terminal according to claim 23, wherein the FCE includes a classification table containing at least one entry having a frame classifier

that is used for classifying the data frame received from the higher layer of the non-MC terminal based on the QoS information contained in the data frame received from the higher layer of the non-MC terminal.

27. The in-band signaling model non-MC terminal according to claim 26, wherein the QoS stream is a new session and the data frame from the higher layer of the non-MC terminal is a first data frame received by the FCE of the non-MC terminal for the QoS stream, and

wherein the FCE of the non-MC terminal adds a new entry to the classification table of the non-MC terminal corresponding to the QoS information contained in the first data frame when the classification table of the FCE of the non-MC terminal does not contain an entry having a frame classifier corresponding to the QoS information contained in the first data frame.

28. The in-band signaling model non-MC terminal according to claim 26, the non-MC terminal includes a counter that is associated with the QoS stream queue, the FCE of the non-MC terminal setting the counter to zero when a data frame that is part of the QoS stream is transmitted in response to a polling message from a media control (MC) terminal of the HPNA network and incrementing the counter when no data frame that is part of the QoS stream is transmitted in response to the polling message, the non-MC terminal removing the entry in the frame classification table corresponding to the QoS stream when a count of the counter that is associated with the QoS stream equals a predetermined value.

29. The in-band signaling model non-MC terminal according to claim 28, wherein the predetermined value equals three.

30. The in-band signaling model non-MC terminal according to claim 23, wherein the HPNA network includes a media control (MC) terminal having a virtual QoS stream queue corresponding to the QoS stream of the data frame received from a higher layer of the non-MC terminal, and

wherein the MC includes a frame scheduling entity (FSE) having a frame scheduling table and a counter that is associated with the virtual QoS stream queue, the FSE setting the counter to zero when a data frame that is part of the QoS stream is transmitted by the non-MC terminal in response to a polling message and incrementing the counter when no data frame that is part of the QoS stream is transmitted by the non-MC terminal in response to the polling message, the FSE removing an entry in the frame scheduling table at the MC terminal for the QoS stream when a count of the counter that is associated with the virtual QoS stream queue equals a predetermined value.

31. The in-band signaling model non-MC terminal according to claim 30, wherein the predetermined value equals three.

32. A method for scheduling transmission of a data frame in a Home Phoneline Network Association (HPNA) network, the method comprising steps of:

receiving a data frame that is part of a down-stream Quality of Service (QoS) stream at a logical link control (LLC) sublayer of an in-band signaling model media control

(MC) terminal, the data frame being received from a higher layer of the MC terminal than the LLC sublayer;

classifying the received data frame for a media access control (MAC) sublayer based on QoS information contained in the data frame received from the higher layer of the MC terminal;

associating the classified data frame with a QoS stream queue that is physically located at the MC terminal and corresponds to a classification of the data frame received from the higher layer of the MC terminal; and

scheduling at the MAC sublayer of the MC terminal transmission of the data frame to a destination for the data frame based on a QoS requirement associated with the down-stream QoS stream.

33. The method according to claim 32, further comprising a step of forming a frame classification table located at the LLC sublayer of the MC terminal, the frame classification table containing at least one entry having a frame classifier that is used for classifying the data frame received from the higher layer of the MC terminal based on the QoS information contained in the data frame received from the higher layer of the MC terminal.

34. The method according to claim 33, further comprising a step of forming a frame scheduling table containing an entry having QoS scheduling information for the QoS stream queue associated with the classified data frame.

35. The method according to claim 34, wherein the QoS scheduling information includes at least one QoS parameter value, a QoS stream identification (ID) for the QoS stream of the classified data frame and queue status information for the QoS stream queue.

36. The method according to claim 35, wherein the queue status information for the QoS stream queue includes queue length information and a last transmission time for a data frame associated with the QoS stream queue.

37. The method according to claim 34, further comprising steps of:
 associating a timer with the QoS stream queue physically located at the MC terminal;
 resetting the timer when the QoS stream queue is not empty;
 enabling the timer to measure an elapsed time when the QoS stream queue becomes empty; and
 removing the entry in the frame scheduling table for the down-stream QoS stream when the QoS stream queue is empty and a predetermined amount of time elapses.

38. The method according to claim 37, further comprising a step of removing the entry in the frame classification table for the down-stream QoS stream when the QoS stream queue is empty and the predetermined amount of time elapses.

39. The method according to claim 37, wherein the predetermined amount of time corresponds to at least three times a maximum delay parameter associated with the down-stream QoS stream.

40. The method according to claim 32, wherein the QoS stream queue includes a plurality of QoS streams.

41. The method according to claim 32, wherein the QoS stream is a new session and the received data frame is a first data frame received for the QoS stream, and

the method further comprising steps of:

adding a new entry to the classification table corresponding to the QoS information contained in the first data frame when the classification table does not contain an entry having a frame classifier corresponding to the QoS information contained in the first data frame; and

adding a new entry to the scheduling table corresponding to the new QoS stream.

42. The method according to claim 32, wherein the down-stream QoS stream is a multimedia session QoS stream.

43. The method according to claim 32, wherein the down-stream QoS stream is a voice session QoS stream.

44. The method according to claim 32, wherein the down-stream QoS stream is a data session QoS stream.

45. The method according to claim 32, wherein the destination for the data frame is at least one in-band signaling model non-media control (non-MC) terminal,

the method further comprising steps of:

receiving a data frame at an LLC sublayer of at least one non-MC terminal, the data frame received at the LLC sublayer of the non-MC terminal being received from a higher layer of the non-MC terminal and being part of a QoS stream originating at the non-MC terminal; and

classifying the data frame received from the higher layer of the non-MC terminal for a MAC sublayer of the non-MC terminal based on QoS information contained in the data frame received from the higher layer of the non-MC terminal.

46. The method according to claim 43, further comprising a step of forming a frame classification table the LLC sublayer of the non-MC terminal, the frame classification table containing at least one entry having a frame classifier that is used for classifying the data frame received from the higher layer of the non-MC terminal based on the QoS information contained in the data frame received from the higher layer of the non-MC terminal.

47. The method according to claim 46, wherein the QoS stream is a new session and the data frame received from the higher layer of the non-MC terminal is a first data frame received at the LLC sublayer of the non-MC terminal for the QoS stream,

the method further comprising steps of:

adding a new entry to the frame classification table of the non-MC terminal corresponding to the QoS information contained in the first data frame received from the

higher layer of the non-MC terminal when the frame classification table of the non-MC terminal does not contain an entry having a frame classifier corresponding to the QoS information contained in the first data frame received from the higher layer of the non-MC terminal;

sending a reservation request message to the MC terminal;

adding a new entry to scheduling table of the MC terminal upon receiving the reservation request message.

48. The method according to claim 46, further comprising steps of:

associating a counter with the QoS stream queue for the QoS stream originating at the non-MC terminal;

setting the counter to zero when a data frame that is part of the QoS stream originating at the non-MC terminal is transmitted in response to a polling message;

incrementing the counter when no data frame that is part of the QoS stream originating at the non-MC terminal is transmitted in response to the polling message; and

removing the entry in the frame classification table corresponding to the QoS stream originating at the non-MC terminal when a count of the counter that is associated with the QoS stream originating at the non-MC terminal equals a predetermined value.

49. The method according to claim 48, wherein the predetermined value equals three.

50. The method according to claim 45, further comprising steps of:

forming a virtual QoS stream queue corresponding to the classified data frame received by the FCE of the non-MC terminal from the higher layer of the non-MC terminal;

forming an entry corresponding to the virtual QoS stream queue in the frame scheduling table at the MC terminal;

associating a counter with the virtual QoS stream queue;

setting the counter to zero when a data frame that is part of the QoS stream originating at the non-MC terminal is transmitted in response to a polling message;

incrementing the counter when no data frame that is part of the QoS stream originating at the non-MC terminal is transmitted in response to the polling message; and

removing the entry in the frame scheduling corresponding to the virtual QoS stream queue when a count of the counter that is associated with the virtual QoS stream queue equals a predetermined value.

51. The method according to claim 50, wherein the predetermined value equals three.

52. A method for transmitting a data frame in an in-band signaling model Home Phoneline Network Association (HPNA) network, the method comprising steps of:

receiving a data frame that is part of a Quality of Service (QoS) stream at a logical link control (LLC) sublayer of an in-band signaling model non-media control (non-MC) terminal, the data frame being received from a higher layer of the non-MC terminal than the LLC sublayer, and the QoS stream originating at the non-MC terminal;

classifying the data frame received from the higher layer of the non-MC terminal for a media access control (MAC) sublayer of the non-MC terminal based on QoS

information contained in the data frame received from the higher layer of the non-MC terminal;

associating the classified data frame with a QoS stream queue physically located at the MAC sublayer of the non-MC terminal when a classification of the data frame corresponds to the at least one QoS parameter value that is associated with the QoS stream queue;

receiving a polling message from an in-band signaling model media control (MC) terminal relating to the QoS stream queue; and

transmitting the received data frame to a destination in response to the received polling message.

53. The method according to claim 52, wherein the QoS stream is an up-stream QoS stream.

54. The method according to claim 52, wherein the QoS stream is a side-stream QoS stream.

55. The method according to claim 52, further comprising a step of forming a frame classification table containing at least one entry having a frame classifier that is used for classifying the data frame received from the higher layer of the non-MC terminal based on the QoS information contained in the data frame received from the higher layer of the non-MC terminal.

56. The method according to claim 55, wherein the QoS stream originating at the non-MC terminal is a new session and the data frame received from the higher layer of the non-MC terminal is a first data frame received by the non-MC terminal for the QoS stream, and

the method further comprising a step of adding a new entry to the frame classification table of the non-MC terminal corresponding to the QoS information contained in the first data frame when the classification table of the FCE of the non-MC terminal does not contain an entry having a frame classifier corresponding to the QoS information contained in the first data frame.

57. The method according to claim 55, further comprising steps of:

associating a counter with the QoS stream queue for the QoS stream originating at the non-MC terminal;

setting the counter to zero when a data frame that is part of the QoS stream originating at the non-MC terminal is transmitted in response to a polling message from an in-band signaling model media control (MC) terminal;

incrementing the counter when no data frame that is part of the QoS stream originating at the non-MC terminal is transmitted in response to the polling message; and

removing the entry in the frame classification table corresponding to the QoS stream originating at the non-MC terminal when a count of the counter that is associated with the QoS stream originating at the non-MC terminal equals a predetermined value.

58. The method according to claim 57, wherein the predetermined value equals three.

59. The method according to claim 52, further comprising steps of:

- forming a virtual QoS stream queue corresponding to the classified data frame received by the FCE of the non-MC terminal from the higher layer of the non-MC terminal;
- forming an entry corresponding to the virtual QoS stream queue in the frame scheduling table at the MC terminal;
- associating a counter with the virtual QoS stream queue;
- setting the counter to zero when a data frame that is part of the QoS stream originating at the non-MC terminal is transmitted in response to a polling message;
- incrementing the counter when no data frame that is part of the QoS stream originating at the non-MC terminal is transmitted in response to the polling message; and
- removing the entry in the frame scheduling corresponding to the virtual QoS stream queue when a count of the counter that is associated with the virtual QoS stream queue equals a predetermined value.

60. The method according to claim 59, wherein the predetermined value equals three.